STATE OF OHIO

FRANK J. LAUSCHE, Governor

DEPARTMENT OF NATURAL RESOURCES

A. W. MARION, Director

DIVISION OF GEOLOGICAL SURVEY

JOHN H. MELVIN, Chief

Information Circular No. 11

Division of Geological Survey

Annual Report

1952

Reprinted from ANNUAL REPORT of the Director
DEPARTMENT OF NATURAL RESOURCES

STATE OF OHIO

Frank J. Lausche,
Governor

DEPARTMENT OF NATURAL RESOURCES

A. W. Marion,
Director

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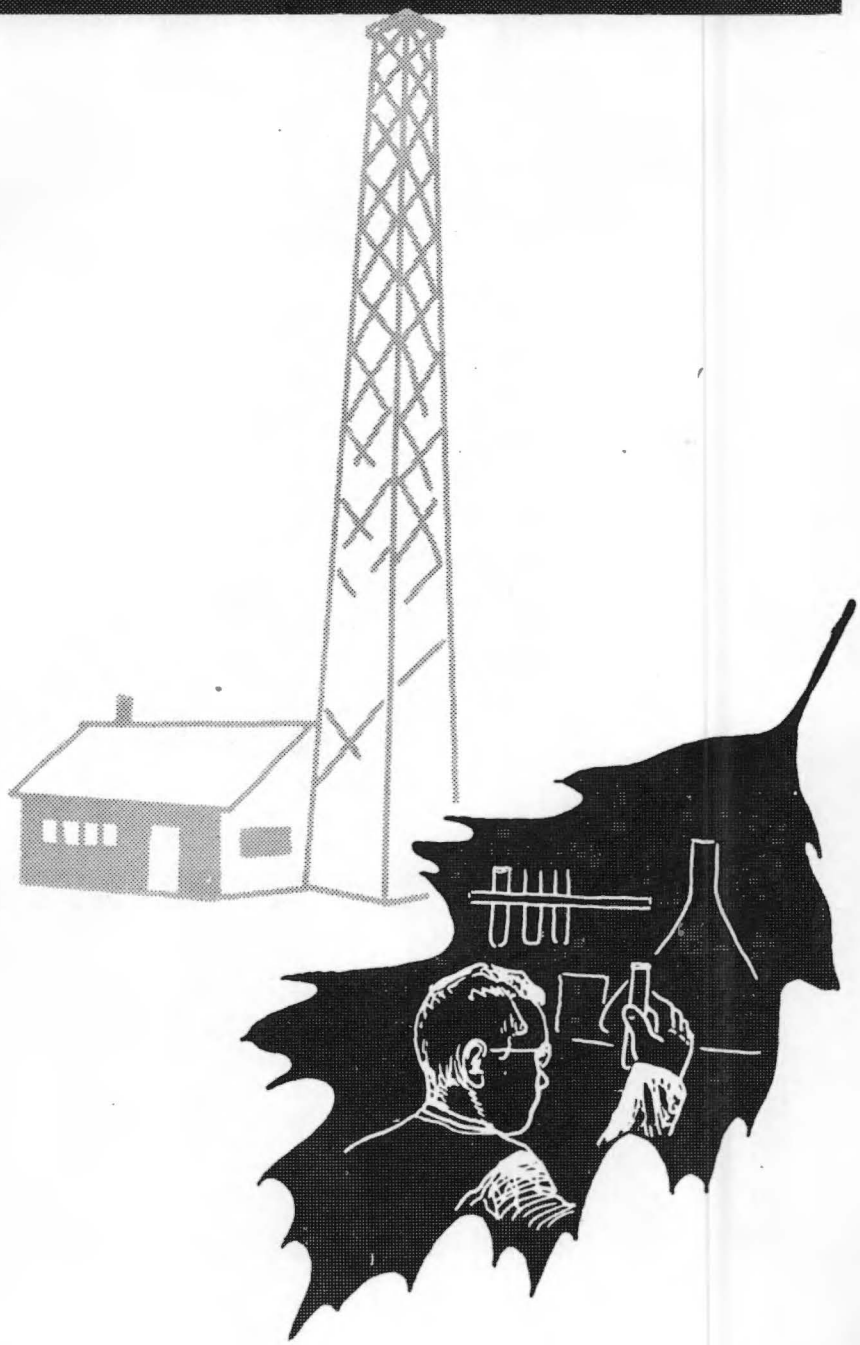
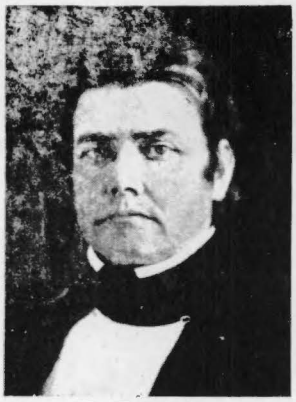
DIVISION OF GEOLOGICAL SURVEY
John H. Melvin,
Chief

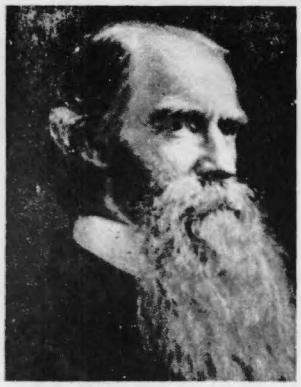
Division of Geological Survey



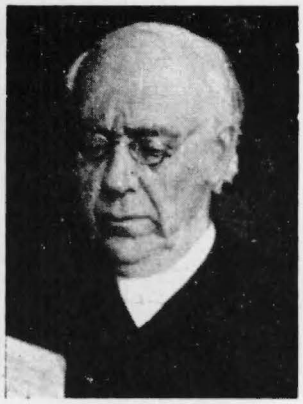
Former State Geologists



W. W. Mather

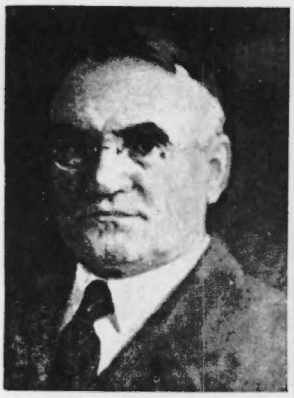


J. S. Newberry



Edward Orton

Edward Orton, Jr.



John Bonocker

Wilbur Stout

George White

DIVISION OF GEOLOGICAL SURVEY

JOHN MELVIN, Chief

HISTORY OF THE SURVEY

When the Ohio Legislature met in 1803, one hundred and fifty years ago, one of its first acts concerned a mineral resource of the State. It established regulations for the operation of the salt industry, at that time a monopoly since the State owned all of the salt springs, or licks.

During the next 33 years more and more interest was shown in the local mineral resources and geology and in 1835 Governor Robert Lucas in his annual message to the Legislature officially suggested the establishment of a State geological survey. As a result, a committee was appointed and in accordance with its recommendations the next legislature in March 1837 passed an act establishing the Ohio Geological Survey. Professor W. W. Mather was appointed State Geologist and with a five-man staff started to work. A report was furnished to the Governor in December 1837 and issued early in 1838 as "First Annual Report of the Geological Survey of the State of Ohio." Work continued and a second report was made in December 1838. Because of the general financial condition of the State, appropriations for the work were not renewed and the geological survey was discontinued at the end of 1838.

It was not until 1869, thirty-one years later, that popular demand for mineral resource and geological information became so great that a Second Geological Survey was set up by the legislature. The second State Geologist was Professor J. S. Newberry who also retained his position as Professor of Geology in the School of Mines of Columbia College in New York City. During the next ten years the results of the studies by the members of the Survey appeared in a number of thick volumes. After a brief suspension of activity the Second Survey again received legislative support in 1882 and Professor Edward Orton took charge as the third State Geologist. The work was carried on intermittently for the next six years and several additional reports were printed, emphasizing particularly the new discoveries of oil and gas.

In 1889 the Third Geological Survey was established on the basis of continuing work; although on a rather small scale. Dr. Orton was in charge of this work too but illness prevented his active participation and although he retained the title of State Geologist it was largely an honorary gesture and no appropriations were made.

After Dr. Orton's death in 1899 his son, Edward Orton, Jr., was appointed the fourth State Geologist. He started the Fourth Survey in 1900 and it has been in continuous operation ever since. Dr. J. A. Bownocker became the fifth State Geologist in 1906 upon the resignation of Edward Orton, Jr. Dr. Bownocker was professor of geology at the Ohio State University and was thus only able to devote summers and spare time to Survey work. In 1921, when the State government was "departmentalized," the Survey became a division of the Department of Education. Upon his death in 1928, the work of

the Survey was separated from the university work and Dr. Wilber Stout became the sixth State Geologist and the first one to devote full time to the work. In 1943 the Survey was transferred to the Department of Public Works.

Dr. Stout retired in 1946 and Dr. George White was appointed the seventh State Geologist. After 15 months of invaluable service to the State, Dr. White was made Chairman of the Geology Department at the University of Illinois and the eighth man to hold the position in 110 years, John H. Melvin, was appointed State Geologist.

Two years later, in 1949, with the passage of Senate Bill 13, the Geological Survey became one of the seven Divisions of the new Department of Natural Resources.

When the Survey started its work few minerals were produced in Ohio, the value of coal was almost unknown and our vast chemical industries, based on limestone and salt, were undreamed of. Today, however, Ohio is a leading mineral producing state and because of these basic raw materials we rank fourth among the manufacturing states. No area of equal size on the face of the earth is so productive.

Men serve and pass on; organizations change in name and location within the framework of state government but the ideal of service to our citizens by conscientious public employees continues uninterrupted. The thoughtful students of our economic development cannot deny that the State Geological Survey has played a major role in making Ohio one of the leading industrial empires on this earth. The credit for this outstanding public service must go to my seven predecessors and to the little band of scientists and engineers who served with them.

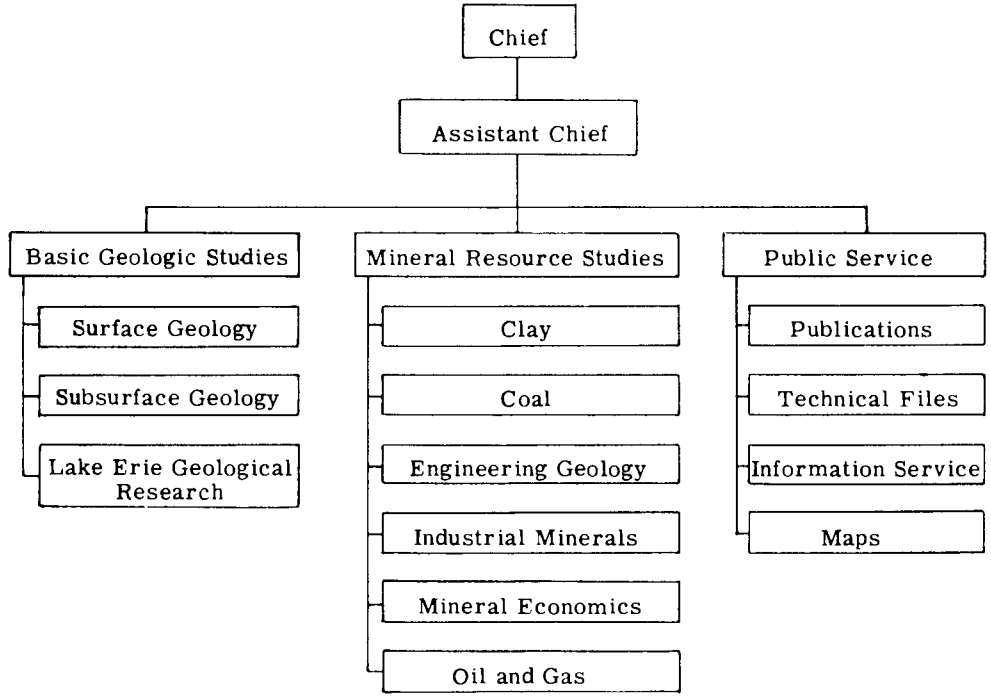
In this sesquicentennial year I sincerely hope that my fellow citizens will pause long enough to read the record and to realize that integrity, responsibility and sacrifice have existed in the public service down through the years. They also exist in the public service today, as those who understand such qualities can easily discern.

ORGANIZATION

In Senate Bill 13 which created the Department of Natural Resources the Legislature directed the Division of Geological Survey to "investigate, survey, interpret and report matters relating to the geological or mineralogical conditions of the State, and to technologies pertaining to them, to the end that industry, commerce, education, public health, and recreation may be advanced."

To meet these many and diversified responsibilities the work of the Survey has been set up as shown on the organization chart. During the past year approximately 25 geologists were employed on full time work. In addition, the services of another 55 professional geologists, professors, and students were utilized during the summer months or on a part time basis to advance the many projects which are described in more detail on the following pages. Many State agencies and some federal organizations either have

State of Ohio
Department of Natural Resources
DIVISION OF GEOLOGICAL SURVEY



Cooperating Agencies

State

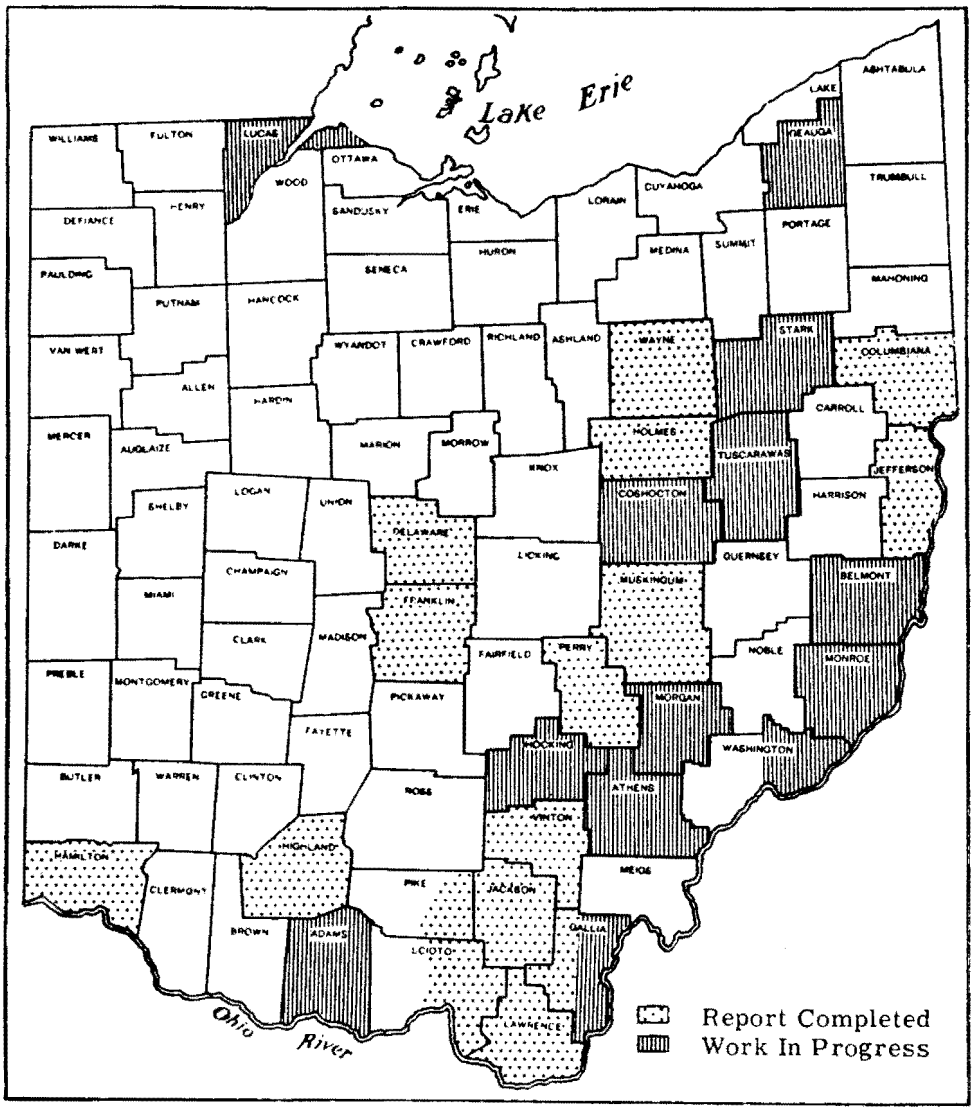
Division of:
- Forestry
- Land and Soil
- Parks
- Shore Erosion
- Water
- Wildlife
- Mines
- Labor Statistics
- Reclamation

Department of:
- Public Works
- Highways

Ohio State University:
- Dept. of Geology
- Eng. Exp. Station
- College of Eng.

Federal

United States:
- Geological Survey
- Bureau of Mines
- Dept. of Agricul.



SURFACE GEOLOGIC STUDIES
Of The
Ohio Division Of Geological Survey

facilities which the Survey can utilize or needs which can be served. Therefore a considerable portion of the past year's work has been in cooperation with these groups, thus eliminating duplication of effort and costly equipment with an ultimate saving to the taxpayer. In the future, as in the past, it is planned to take every advantage of existing facilities and thus to achieve a maximum program at a minimum cost.

The main office of the Division of Geological Survey is located in Orton Hall on the Ohio State University campus. There a staff of technically trained specialists and an accumulation of the results of over 100 years of scientific research are available to serve all who are interested in industrial development, public improvement and the conservation of natural resources.

MINERAL RESOURCE STUDIES

OIL AND GAS

In recent years Ohio has usually ranked eleventh among the states in the production of natural gas and eighteenth in oil production. During 1951 a total of 1,061 wells were reported drilled in 45 counties. Of these 626 were successful and 435 resulted in dry holes; an average of 41% failures. Discoveries amounted to 142,611,000 cubic feet of gas and 9,956 barrels of oil per day initial. Footage drilled totaled 2,083,828.

A record is made of each foot drilled and this log forms a valuable record of the rocks beneath the surface. In many instances the actual samples of rock and brine are recovered and preserved. These records and materials are used by the Geological Survey in its studies of the occurrence of not only oil and gas, but also coal, clay, salt and other mineral resources. Therefore the continued collection of this basic data is one of the important activities of the Survey.

Core drill in operation. This is one of the modern scientific research tools being utilized in a study of the rocks and mineral resources far below the surface of Ohio.

ANNUAL OIL AND GAS DRILLING ACTIVITY REVIEW

The Survey prepares an annual report of drilling activity which indicates the new oil and gas which has been discovered during the year. Such information is invaluable in computing the reserves of these fuels remaining underground. The 1951 report also describes the famous Canton gas pool and the Oriskany sand, an important producing horizon.

COUNTY OIL AND GAS REPORTS

Detailed studies are being made of oil and gas occurrence in various counties and sometimes this information is published as a chapter in the county geologic report. Occasionally a separate publication is justified. During the past year a comprehensive report on these resources in Perry County was released.

COAL

Over half of the State's raw mineral production comes from coal. In 1951 some 37,816,708 tons valued at $142,374,202 were produced from Ohio mines.

Accumulation of basic coal data is one of the major activities of the Coal Section and information is obtained by measurement of outcrops and of exposures in mines, logging of drill holes, preparation of outcrop maps, and analysis of samples. This information is then evaluated and interpreted in order to assist in the location of new prospecting areas and in future development of existing operations. Meanwhile, industry greatly assists in this work by supplying drill cores and logs, coal analyses, mine maps, and samples for analysis.

COAL RESOURCE STUDIES

The determination of original and remaining coal reserves is basic to industrial development for industry must know its fuel resources for many years in advance. Such inventory studies are constantly in process based on information which has been accumulating since 1837.

MEIGS CREEK COAL STUDIES

The beneficiation or improvement of low grade Ohio coal has been another cooperative project with the Engineering Experiment Station. The Meigs Creek, or No. 9 coal, contains very extensive unmined reserves in Ohio, and methods to improve this coal are being studied.

CLAY AND CLAY PRODUCTS

Ohio has long been the leading state in the production of clay and clay products and basic geologic studies in the past have contributed much to this activity and such studies are continuing.

In addition, special clay studies are necessary. During the past year work was done on the clay resources of Perry County and plans were laid for clay mineral studies.

ROCK AND ROCK PRODUCTS

The annual value of rock and rock products produced in Ohio is more than 90 million dollars. Limestone and dolomite are used in metallurgical fluxstone, glassmaking, chemicals, refractories, agricultural limestone, crushed stone for highways, railroad ballast, and construction purposes. As a result, Ohio led all the states in the production of lime and was seventh in cement manufacture. Sandstone and conglomerate are used in glassmaking, refractories, whetstones, building material, and foundry sand. Sand and gravel production was over 15 million dollars and was exceeded by only California and Illinois.

During the past year progress was made in the study of the Sharon Conglomerate, an important source of industrial silica.

ENGINEERING GEOLOGY

Geologic information is being used more and more in the field of construction and civil engineering. Survey personnel furnished information and made reports on the construction of dams and various phases of the Ohio Turnpike during 1951.

BASIC GEOLOGICAL STUDIES

The prime function of the Division of Geological Survey is to assist in the development and wise use of the State's mineral resources. The first step in such a program is the accumulation of many scientific facts which form the basis for practical applications of geologic knowledge. The Survey has long been active in scientific research as a part of its responsibility to the citizens of the State and although the search for scientific truth is time consuming, many long range projects are gradually increasing our fundamental knowledge of Ohio geology.

In addition to its full time staff, the survey is fortunate in obtaining, during the summer months, the service of outstanding geologists and students from colleges and universities to carry on these basic scientific studies. During 1951, progress was made in the following projects:

COUNTY GEOLOGIC REPORTS

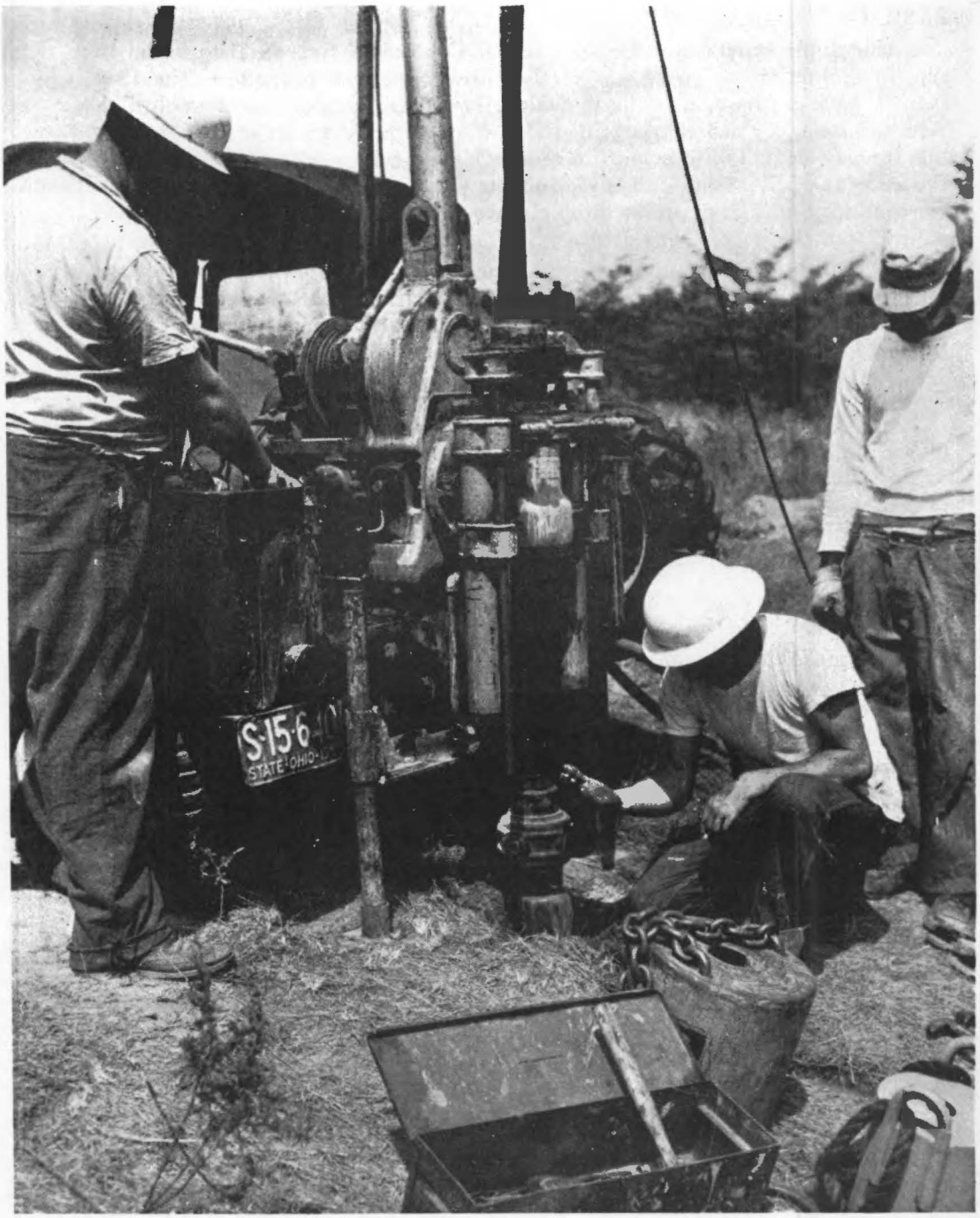
One kind of basic geologic study ultimately leads to the publication of a county report or bulletin. Geologic facts are accumulated, organized, and preserved, sometimes for years, until enough is known about the geology of a county to justify the publication of the report, together with a geologic map. The index map on the opposite page shows the counties in which work is now in progress and also those counties for which completed reports are available.

GEOLOGY OF OHIO FORMATIONS

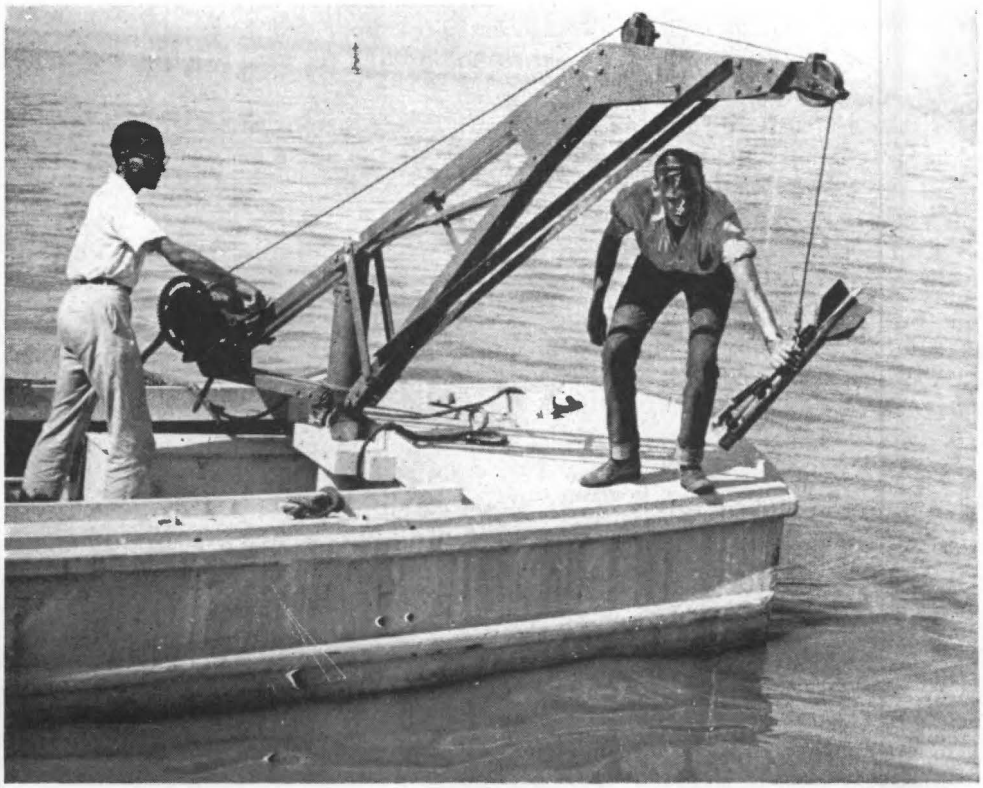
The rocks of the state have been divided into units or formations, thus another way to accumulate basic geologic knowledge is to study the details of these various formations. During the past year progress was made on reports on both the Monongahela and the Mississippian formations and some Pleistocene work was undertaken.

SUBSURFACE GEOLOGIC STUDIES

The studies described above usually involve primarily work on the surface. Records of oil, gas, and water wells and core boring data, together with actual materials recovered from such activities, permit studies of rock formations which lie far beneath the surface. During the past year a section was established in the Division of Geological Survey to devote full time to this important work.



Geologists exploring formations far beneath the surface of Ohio. This jeep-mounted core drill can recover a continuous rock sample to a depth of 500 feet.



Geologists recovering samples of sand from bottom of Lake Erie. Study of such material aids in determining mineral resources of the lake.

LAKE ERIE GEOLOGICAL RESEARCH PROJECT

The Divisions of Shore Erosion, Water, Wildlife, and Geological Survey of the Ohio Department of Natural Resources, and the Department of Geology, Research Foundation, and Graduate School of the Ohio State University are cooperating on a comprehensive study of the geology of Lake Erie. During the past year a considerable body of new geologic information was obtained by this project which is described at some length in the report of the Division of Shore Erosion.

PUBLIC SERVICE

The Geological Survey is a public information bureau in matters relating to mineral resources and earth science. Approximately one-third of the time of the entire staff is spent in answering inquiries by letter, telephone, and personal conference. The Survey is always ready to assist in the development and conservation of mineral resources and to serve the citizens of the State.

By the preparation of articles and the presentation of talks before various organizations, schools, and interested groups, the Survey furnishes accurate and timely information on the geology and mineral resources of the State.

The Division had a part in the Department of Natural Resources exhibit at the Ohio State Fair and at several of the Sportsmen's shows. Assistance has also been given in the preparation of geological exhibits in various buildings on the Ohio State University campus.

Additional work was done on an Economic Geography of Ohio which will be available during the Sesquicentennial year.

Progress was made also on a new Bibliography of Ohio Geology, a compilation which will be of great value in future geologic work.

The Survey is the depository for a complete set of air photos of Ohio and these were consulted by many individuals and organizations. The Survey also carries on the work formerly assigned to the Ohio Topographic Survey and thousands of maps were distributed under this program.

Another public service is the exchange of publications with other scientific organizations throughout the world. During the past year 932 additions were received by the Survey and deposited in the Orton Memorial Library of Geology on the Ohio State campus.

DIVISION OF GEOLOGICAL SURVEY PUBLICATIONS

The results of scientific study are of value only if available to a large number of people of the State. During the past year the following items were released:

BULLETINS

Bulletin 48. Geology of Perry County: by Norman K. Flint. 234 pp., 1951. Physiography; structure and stratigraphy; economic geology; geologic sections. Geologic map and map showing drainage changes. Price $2.00 plus 6 cents tax in Ohio.

Bulletin 49. Limestones of Eastern Ohio: by Raymond E. Lamborn. 377 pp., 1951. Preliminary considerations; bedrock formations; discussion by counties; table of analyses; map showing location of samples. Price $2.00 plus 6 cents tax in Ohio.

REPORTS OF INVESTIGATIONS—FREE

R. I. No. 9. (Contribution No. 1, Lake Erie Geological Research Program). 1950 Investigation of Lake Erie Sediments, Vicinity of Sandusky, Ohio: by Howard J. Pincus, Marjorie L. Roseboom, Curtis C. Humphris. 37 pp., 1951.

R. I. No. 10. (Petroleum and Natural Gas Series No. 2). Oil and Gas in Perry County: By Robert L. Alkire. 64 pp., 1952.

R. I. No. 11. Additional analyses of brines from Ohio: By Raymond E. Lamborn. 56 pp., 1952.

R. I. No. 12. Illinoian and Wisconsin drift of the southern part of the Grand River Lobe in Eastern Ohio: By George W. White. 11 pp., 1951.

R. I. No. 13. (Petroleum and Natural Gas Series No. 3). Part 1. Oil and gas well drilling statistics for 1951: Compiled by Robert L. Alkire. Part 2. Oriskany sand study: By John F. Hall; Canton gas pool: By Henry Belden; wells drilled in Ohio 1888-1951; oil and gas producing charts, well sample cuttings index. 137 pp., 1952.

R. I. No. 14. The Pittsburgh Coal of Federal Creek Field, 1952.

INFORMATION CIRCULARS—FREE

I. C. No. 7. Division of Geological Survey annual report 1951: By John H. Melvin.

REPRINT SERIES

Reprint Series No. 4. The Orleton Farms mastodon: By Edward S. Thomas; Geological situation of the Orleton Farms mastodon: By Richard P. Goldthwait; Pollen spectra associated with the Orleton Farms mastodon site, Madison County, Ohio: By Aurele La Rocque; Toothmarks on bones of the Orleton Farms mastodon: By Albert E. Wood. 28 pp., 1952. Free.

EDUCATIONAL LEAFLETS SERIES—FREE (WITH OHIO STATE UNIVERSITY GEOLOGICAL MUSEUM)

E. L. S. No. 1. The source of uranium: By Carl A. Lamey.

E. L. S. No. 2. Who was who in the ice age?: By Grace A. Stewart.

MISCELLANEOUS

Handbook for Teachers of Earth Science: By Mildred Fisher Marple and Walter C. Brown. Limited edition prepared for the Central Ohio Science Teachers Club.

ARTICLES BY SURVEY STAFF PUBLISHED BY OTHER ORGANIZATIONS

ALKIRE, R. L.—Ohio Oil and Gas Development 1951; Year Book, 1951: National Oil Scouts and Landmen's Association.

Developments in Ohio in 1951; Review of Exploration and Developments in 1951: A. A. P. G.

Oil and Gas Developments in Ohio During 1951; Statistics of Oil and Gas Development and Production: A. I. M. E.

AUKLAND, MERRILL FORREST—Geology of Waterloo and Lee Townships, Athens County, Ohio; A thesis presented for the degree of Master of Science, 1952, Rutgers University.

BLAKE, OLIVER—Geology of Gallia County, Ohio; Dissertation presented for the degree of Doctor of Philosophy, The Ohio State Universtiy, 1952.

CROMBIE, RICHARD, B.Sc.—Stratigraphy of Newark, Madison and part of Hanover Townships, Licking County, Ohio; A thesis presented for the degree of Master of Science, The Ohio State University, 1952.

FAGADAU, SANFORD P.—Stratigraphy and Paleontology of the Logan Formation of Southern Ohio; A dissertation presented for the degree of Doctor of Philosophy, 1952.

HALL, JOHN F.—The Geology of Southern Hocking County, Ohio; Dissertation for the degree of Doctor of Philosophy, The Ohio State University, 1951. (Benton, Laurel, Salt Creek, Starr, and Washington Townships in Hocking County).

JACKSON, ROBERT REED—A petrographic study of the Middle Devonian limestone of central Ohio and the Bellefontaine outlier; A thesis presented for the degree of Master of Science, The Ohio State University, 1952.

JESSUP, DONALD EDWARD—The Geology of a part of Jackson Township, Pike County, Ohio; A thesis presented for the degree of Master of Science, The Ohio State University, 1951.

MELVIN, JOHN H.—Ohio's Rocks; Engineering Experiment Station News: Ohio State University, April, 1952.

MELVIN, JOHN H. AND RUNKLE, DORIS M.—Chart of Income, Activities and Personnel of State Geological Surveys 1951: Prepared for the American Association of State Geologists.

MELVIN, JOHN H.—Ohio on the Rocks: Ohio Conservation Bulletin, April, 1952.
Ohio Division of Geological Survey; Alumni Newsletter, Department of Geology, The Ohio State University, June, 1952.

PINCUS, HOWARD J.—Land Hungry Lake Erie: Ohio Conservation Bulletin, June, 1952.

RUNKLE, DORIS M.—Celestite; Natural Resource Publication No. 11: Ohio Chamber of Commerce, 1951.

Gypsum; Natural Resource Publication No. 13: Ohio Chamber of Commerce, 1952.

SMITH, GILBERT E.—Geology of Ames Township, Athens County; A thesis presented for the degree of Master of Science, West Virginia University.

TUCKER, W. M.—Pyrite Deposits in Ohio Coal, Reprinted from Economic Geology, Vol. XIV, No. 3, May 1919; Natural Resource Publication No. 10: Ohio Chamber of Commerce, 1951.

WATKINS, DOROTHY GERLACH—Ohio's Lime Industry; Natural Resource Publication No. 12: Ohio Chamber of Commerce, 1951.

FUTURE WORK OF THE DIVISION OF GEOLOGICAL SURVEY

The mineral resources of Ohio have been recognized for a long time as the basis for her industrial greatness. Although one of the smallest states in area, we are seventh in total value of raw minerals produced since 1911.

Minerals are a non-renewable resource. The richest deposits and those easiest to locate and to work are the first to be utilized, therefore with the passage of time it becomes more and more difficult to find and to use lower and lower grade deposits. It is highly important then, that to support our ever expanding industrial economy with an ever decreasing mineral potential requires the best vision and assistance that industry, the State, and the federal government can give.

The field of activity of the Ohio Division of Geological Survey in this struggle to build and maintain our present way of life was laid down by the legislature in 1837 and expressed in modern terms in Senate Bill 13 which created the Department of Natural Resources. In essence, the Geological Survey is directed to "investigate, survey, interpret, and report matters relating to the geological or mineralogical conditions of the State and to technologies pertaining to them, to the end that industry, commerce, education, public health, and recreation may be advanced."

Changes in mineral uses, new technologies, and the exhaustion of some mineral resources will naturally require a change in the details of the work of the Survey. The major course for future development can be accurately charted however and this organization has been operating under such a plan for the past five years.

In 1948 the Survey made a thorough study of the needs of Ohio in the geological field. Agriculturists, industrialists, coal, oil, gas, clay, lime, stone and chemical industries and the average citizens were consulted as to the type and amount of information needed. The activities of other states with similar income from the mineral industries and similar problems were included in the detailed study. Specialists in particular fields of geology were called in for reports in their own fields of activity and all of this information was evaluated in the light of the Survey's generations of service to the citizens of the state and some long-range objectives set up. In re-evaluating the plans of 1948 in the light of present day conditions, the Division of Geological Survey is working toward the following objectives:

1. A balanced program of basic scientific research; practical application of that research and the making of our findings available to those who need and use geologic and mineral industry information. At the present time we have some fifty separate projects or studies moving forward and many of these can only be worked on for a small part of each year. However, acceleration of many of these projects is highly desirable so that information will be available when needed. Meanwhile a number of additional studies designed to assist our citizens when certain mineral deposits approach exhaustion should also be undertaken.

The results of these studies are only of use if available to those who can use them. This requires the actual publication of maps, bulletins, and reports. During the past few years, by adopting modern printing techniques, we have been able to increase the amount of printing we get from each dollar in spite of the rise in printing costs. Our publication program is in good shape, but it must keep pace with our accelerated studies. Future plans call for approximately doubling our output of scientific work.

2. Adequate space is essential for scientific geologic work. At the present time we occupy approximately 8,000 square feet in seven separate buildings scattered about Columbus. Some 5,000 square feet of this space is of a temporary nature so that even the present activities of the Survey are in danger of serious curtailment.

It is estimated that a minimum of 15,000 square feet of office, laboratory, and storage space will be required to adequately accommodate the proposed studies. Future space plans call for the taking advantage of any situation which presents itself to alleviate these intolerable conditions.

An addition to the present geology building on the Ohio State campus would be of great assistance. The construction of a mineral industry center on the campus would also be welcomed. Space in a State Natural Resources

building would be another solution to the problem. The assignment of a geologist to each District Office of the Department would also ease the situation.

3. A competent and adequate scientific staff is essential to serve the citizens of the State. The work of the Geological Survey is primarily scientific research of a high degree, requiring highly trained personnel. All but two of our present twenty-two full time employees have at least one college degree, some having two, some three. Because of the shortage of such highly trained personnel throughout the country it is a real problem as to how to attract and hold employees at the State salary level.

Our full time staff is supplemented by college professors and advanced students working for short periods on special problems. During the past year approximately fifty such part time or seasonal employees worked for the Survey. The proposed future staff would number between forty and fifty full time employees and about the same number of seasonal and part time help.

4. A greater number of cooperative projects with other agencies and organizations is desirable. However, it is not the intention of the Survey to in any way duplicate the work or facilities of other agencies. For instance, the State has excellent chemical and coal laboratories at the Engineering Experiment Station on the Ohio State University campus, and the Survey makes use of these facilities when needed by cooperating with the Station and thus eliminating the necessity for similar laboratories of its own.

We are at present cooperating with a number of State and federal agencies to achieve information at great saving to the taxpayer. This kind of effort will be accelerated as opportunity permits.

5. A legislative appropriation which will permit the Division of Geological Survey to meet its obligations under Senate Bill 13 is imperative. The following table illustrates the financial condition of the Survey during the past seven years:

Year	Legislature Appropriation	Total Funds Available	Budget Requests
1946	$ 14,940	$ 25,493	$ .....
1947	28,575	29,305	68,360
1948	38,175	61,279	81,225
1949	61,741	80,000	207,287
1950	52,978	81,179	198,948
1951	123,688	149,098	330,854
1952	127,108	150,000	340,190

Under present conditions, when the Survey is fully set up and equipped to do the job, an annual legislative investment of approximately $250,000 will be required to carry on its geologic work. This is but a small fraction of the annual return in taxes to the State from the results of such studies.

PUBLICATIONS AVAILABLE FROM THE DIVISION OF GEOLOGICAL SURVEY

(All Publications Are Subject to Ohio Sales Tax)

BULLETINS

No.

1. The Occurrence and Exploitation of Petroleum and Natural Gas in Ohio; 1903; $0.65.
2. The Uses of Hydraulic Cements; 1904; $0.30.
3. The Manufacture of Hydraulic Cements; 1904; $1.50.
4. The Limestone Resources and the Lime Industry in Ohio; 1906; $1.50
5. The Manufacture of Artificial Sandstone and Sand Lime Brick; 1905; Bound with Bulletin 4 in Volume 9.
6. A Bibliography of Ohio Geology; 1906; $0.35.
7. Revised Nomenclature of the Ohio Geological Formations; 1905; $0.10.
8. Salt Deposits and the Salt Industry in Ohio; 1906; $0.10.
9. Coal; 1908; $0.50.
10. The Middle Devonian of Ohio; 1909; $0.25.
11. The Manufacture of Roofing Tiles; 1910; $0.75.
12. The Bremen Oil Field; 1910; $0.20.
13. The Maxville Limestone; 1910; $0.20.
14. Geology of the Columbus Quadrangle; 1911; $0.30.
15. The Devonian and Mississippian Formations of Northeastern Ohio, 1912; $1.50.
16. Peat Deposits of Ohio; 1912; $0.75.
17. Conemaugh Formation in Ohio; 1912; $0.60.
18. Building Stones of Ohio; 1915; $0.30.
19. Geology of Cincinnati and Vicinity; 1916; $1.00.
20. Geology of Southern Ohio; 1916; $1.25.
21. Geology of Muskingum County; 1918; $1.50.
22. The Dunkard Series of Ohio; 1920; $0.60.
23. Geology of the Camp Sherman Quadrangle; 1921; $0.50.
24. Geology of Wayne County; 1921; $0.50.
25. Pottsville Fauna of Ohio; 1922; $0.75.
26. Coal Formation Clays of Ohio; 1923; $1.50.
28. Geology of Columbiana County; 1924; $1.00.
30. Geology of Delaware County; 1926; $0.75.
31. Geology of Vinton County; 1927; $1.00.
32. Fauna of the Silica Shale of Lucas County; 1927; $0.50.
34. Analyses of Coals of Ohio; 1929; $1.00.
35. Geology of Jefferson County; 1930; $1.00.
36. The Lawrence Clay of Lawrence County; 1931; $0.50.
37. Brines of Ohio; 1932; $0.50.
38. Geology of Highland County; 1936; $0.75.
39. Shales and Surface Clays of Ohio; 1938; $1.00.
40. Clarion Clay of Hope and Lincoln Furnace Fields; 1940; $0.25.
41. Marl, Tufa Rock, Travertine, and Bog Ore in Ohio; 1940; $0.25.
42. Dolomites and Limestones of Western Ohio; 1941; $1.50.
43. The Coal Beds of Western Carroll County and Southeastern Mahoning County; 1942; $0.20.
44. Geology of Water in Ohio; 1943; $1.50.
45. The Iron Ore Bearing Formations of Ohio; 1944; $1.20.

46. The Occurrence of Flint in Ohio; 1945; $0.50.
47. Geology of Holmes County; 1948; $2.00.
48. Geology of Perry County; 1951; $2.00.
49. Limestones of Eastern Ohio; 1951; $2.00.

REPORTS OF INVESTIGATIONS

No Charge

No.

1. Waynesburg Coal in Harrison and Northern Belmont Counties, Ohio, and Revision of Dunkard (Permian) Boundary; 1947.
2. Geologic Section of the Chillicothe Test Core; 1947.
3. Areal Extent and Thickness of the Salt Deposits of Ohio; 1947.
4. Additional Analyses of Coals in Ohio; 1949.
6. Sand and Gravel Resources in Northern Ohio; 1949.
7. Shore Erosion on Sandusky Bay; 1951.
8. Ohio Oil and Gas Well Drilling Statistics for 1950; 1951.
9. 1950 Investigation of Lake Erie Sediments, Vicinity of Sandusky, Ohio; 1951.
10. Oil and Gas in Perry County; 1952.
11. Additional Analyses of Brines from Ohio; 1951.
12. Illinoian and Wisconsin Drift of the Southern Part of the Grand River Lobe in Eastern Ohio; 1951.
13. Oil and Gas Well Drilling Statistics for 1951; 1952.
14. The Pittsburgh Coal of the Federal Creek Field; 1952.

INFORMATION CIRCULARS

No Charge

No.

3. Recent Information on the Maxville Limestone; 1945.
4. Generalized Section of Rocks of Ohio.
5. An Additional Fossiliferous Member in the Allegheny Formation (Pennsylvanian) of Ohio; 1949.
7. Division of Geological Survey Annual Report 1951.

EDUCATIONAL LEAFLET SERIES

No Charge

No.

1. The Source of Uranium.
2. Who Was Who in the Ice Age?

REPRINT SERIES

No.

1. Physiographic Features of Southeastern Ohio; $0.15.
2. Glass Sands and Molding Sands; $0.20.
3. The Geologic Interpretation of Scenic Features in Ohio; 1946; $0.15.
4. The Orleton Farms Mastodon; 1952; no charge.

OHIO CO-OPERATIVE TOPOGRAPHIC SURVEY

Volume

I. Ohio-Michigan Boundary; 1916; $0.50.
II. Surveying Monuments and Marks; 1917; $1.00.
III. Public Land Surveys; 1925; $3.00.
IV. Miscellaneous Data; $1.00.

MAPS

Geologic Map of Ohio; 1947; $1.00.

Mineral Industry Map of Ohio; 1947; $0.50.

Map of Oil and Gas Fields of Ohio; 1948; $1.00.

Map of Oil and Gas Pipe Lines in Ohio; 1949; $1.50.

Base Map of Ohio; $0.10.

Geologic Map of Holmes County; 1947; $0.50.

Geologic Map of Coshocton County; 1947; $1.00.

Geologic Map of Perry County; 1948; $1.00.

Maps showing Outcrop and Extent of Meigs Creek Coal in Cumberland and Caldwell Quadrangles; 1947; $0.25.

FINANCIAL STATEMENT

The following is a statement of funds available and expended by the Division of Geological Survey for the year ending June 30, 1952:

		Funds Available	Expenditures	Unencumbered Balance
	H. B. No. 671			
A-1	Salaries	$ 79,214.29	$ 77,356.65	$ 1,857.64
A-2	Wages	10,062.00	7,804.65	2,257.35
C-4	Office supplies	1,000.00	993.44	6.56
C-4a	Postage	1,000.00	1,000.00	.....
C-10	Motor vehicles supplies	1,000.00	1,000.00	.....
C-11	Other supplies	500.00	494.84	5.16
E-1	Office equipment	2,000.00	1,989.76	10.24
E-6	Motor vehicles equipment	3,700.00	3,699.77	.23
E-9	Tools and machinery	2,070.00	2,007.25	62.75
F-1a	Other Repairs	200.00	197.13	2.87
F-2	Motor vehicle repairs	500.00	500.00	.....
F-5	Express	117.46	117.46	.....
F-6	Traveling expenses	5,930.00	5,925.05	4.95
F-7	Communication	400.00	397.70	2.30
F-8	Printing service	9,600.00	9,597.82	2.18
F-9	Other	2,800.00	2,798.98	1.02
F-9a	Consulting service	3,732.54	3,731.56	.98
	TOTAL	$123,826.29	$119,612.06	$4,214.23
	H.B. No. 672			
E-6		124.25	124.25	.....
	TOTAL	$ 124.25	$ 124.25	.....

Income from sales of bulletins, maps, photostats, etc., was $1,829.86 for the fiscal year 1952. This money is paid directly into the General Revenue Fund.

Conservation Pledge

I GIVE MY PLEDGE
AS AN AMERICAN
TO SAVE AND FAITHFULLY TO
DEFEND FROM WASTE
THE NATURAL RESOURCES OF
MY COUNTRY — ITS SOIL
AND MINERALS, ITS
FORESTS, WATERS,
AND WILDLIFE